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Modelling the magnetic field in Mercury's magnetosheath

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The main focus of the present work is to estimate the accuracy of the new assimilated model (based on the paraboloid model of magnetosphere by Moscow State University and the 3D hybrid model by Aalto University) for Mercury's magnetic field in the magnetosheath by comparing its predictions with MESSENGER magnetometer measurements along several typical orbits. The duration of each magnetosheath pass is approximately one hour for dawn-dusk orbits, which is substantially longer than characteristic times of inner magnetospheric processes as well as the time required for solar wind to flow past Mercury's magnetosphere (approximately 1 min for $L \sim 10R_M$).

Because of that, we need to carefully select the orbits to use from the available array of over 8000 magnetosheath crossings to satisfy the necessary condition of similar solar wind properties in orbit segments incoming and outgoing the magnetosheath.

We pay special attention to the differences in the Mercury-solar wind interactions for southward and northward IMF. Dependence of reconnection phenomena on the IMF B_z direction is clearly demonstrated by our assimilated hybrid and paraboloid model simulation runs. We also examine the magnetosheath plasma parameters for signatures of a plasma depletion layer and examine the properties of Mercury's magnetopause.